AMENDMENTS TO THE CLAIMS

Please amend the claims as follows:

1. (Currently amended) A method of building an electronic database for data resolution synthesis from at least one training file, the method comprising:

generating a low-resolution file from each training file;

generating a plurality of cluster vectors from different regions of the low-resolution files;

generating a plurality of representative vectors from the cluster vectors ~~low-resolution files~~; and

generating a set of interpolation filters for each of the representative vectors~~;~~, whereby the interpolation filters and the representative vectors can be used to perform data resolution synthesis on a file other than the training file.

2. (Original) The method of claim 1, wherein the representative vectors are generated by computing a number of NCV of cluster vectors from each low resolution file and using the cluster vectors to compute the representative vectors; and wherein low-resolution observation vectors, the cluster vectors, the representative vectors and a high-resolution file corresponding to each low-resolution file are used to compute the interpolation filters, whereby a high resolution file may be a training file.

3. (Original) The method of claim 2, further comprising the step of generating a sharpened high-resolution file, the sharpened high-resolution file being used to compute the interpolation filters.

4. (Original) The method claim 2, wherein the representative vectors are generated by using a maximum likelihood estimate.

5. (Original) The method of claim 4, wherein the vectors are generated by using an expectation maximization technique.

6. (Original) The method of claim 4, wherein a classifier including the representative vectors is computed by initializing the classifier and updating the classifier until optimal values for the classifier have been updated.

7. (Original) The method of claim 6, wherein the classifier further includes a variance and a number M of class weights, and wherein the representative vectors, the class weights and the variance are computed simultaneously.

8. (Original) The method of claim 2, wherein each cluster vector is generated by forming an observation window about sampled data in a low resolution file, extracting a vector including neighboring data of the sampled data, and scaling the vector.

9. (Original) The method of claim 2, wherein coefficients for the interpolation filters are computed by:

computing a number NFDV of filter design triplets from data in the low-resolution file, where NFDV is a positive integer, each filter design triplet corresponding to sampled data in the low-resolution file, each filter design triplet including an observation vector for the sampled data, a cluster vector for the sampled data, and a vector of high resolution data from a high-resolution file;

computing training statistics from the filter design triplets; and

computing the coefficients from the training statistics.

10. (Original) The method of claim 2, wherein the steps are run off-line in a computer.

11. (Original) The method of claim 1, wherein the interpolation filters are linear filters.

12. (Original) The method of claim 1, wherein the representative vectors are generated by using a parameter optimization technique.

13. (Currently amended) A method of using a computer to compute a plurality of resolution synthesis parameters from a training image, the method comprising the steps of:

computing a low-resolution image from the training image;

computing a plurality of cluster vectors ~~for~~ from a number NCV of pixels in the low-resolution image, where NCV is a positive integer;

computing ~~using the cluster vectors to compute~~ a number M of representative vectors from the cluster vectors ~~for the low resolution image~~, where M is a positive integer that is less than NCV; and

using low-resolution observation vectors, the cluster vectors, the representative vectors and vectors from a high-resolution image to compute sets of interpolation filter coefficients corresponding to each of the representative vectors;

whereby the high-resolution image may be the training image; and

whereby the interpolation filter coefficients and the number M of representative vectors are stored in the database for later interpolation of an image other than the training image.

14. (Original) The method of claim 13, wherein the number NCV is between 25,000 and 100,000, whereby between 25,000 and 100,000 cluster vectors are computed.

15. (Original) The method of claim 13, wherein each cluster vector for a non-border pixel is computed by extracting a first vector from a square observation window centered about a sampled pixel in the low-resolution image, and scaling the first vector.

16. (Original) The method of claim 13, where the number M of representative vectors is between 50 and 100.

17. (Original) The method of claim 13, wherein the representative vectors are computed using a maximum likelihood estimate.

18. (Original) The method of claim17, wherein a classifier including the representative vectors is computed by initializing the classifier and updating the classifier until optimal values for the classifier have been obtained.

19. (Original) The method of claim 13, wherein the representative vectors are computed using an expectation-maximization algorithm.

20. (Original) The method of claim 19, wherein the representative vectors are computed by:

setting initial values for a classifier including a number M of class weights, a variance and the number M of representative vectors;

computing a quality measure of how well the cluster vectors are represented by the initial values for the classifier;

updating the classifier;

recomputing the quality measure for the updated classifier; and

determining whether the cluster vectors are suitably represented by the updated classifier, the classifier being updated until the cluster vectors are suitably represented.

21. (Original) The method of claim 13, further comprising the step of computing a sharpened high-resolution image from the training image, wherein the sharpened image is used along with low-resolution observation vectors, the cluster vectors and the representative vectors to compute the interpolation filter coefficients.

22. (Original) The method of claim 13, wherein the interpolation filter coefficients are computed by:

computing a number NFDV of filter design triplets from the low-resolution image, where NFDV is a positive integer, each filter design triplet corresponding to a sampled pixel in the low-resolution image, each filter design triplet including an observation vector for the sampled pixel, a cluster vector for the sampled pixel, and a vector of high resolution pixels corresponding to the sampled pixel, the high-resolution pixels being taken from the high resolution image;

computing training statistics from the filter design triplets; and

computing the coefficients from the training statistics.

23. (Original) The method of claim 22, wherein the number NFDV of filter design triplets is between 500,000 and 1,000,000, whereby between 500,000 and 1,000,000 filter design triplets are computed.

24. (Original) The method of claim 22, wherein the interpolation filter coefficients are computed for linear interpolation filters.

25. (Original) The method of claim 13, wherein the steps are run off-line in the computer.

26. (Original) The method of claim 25, wherein the database is stored for transfer to a second computer, whereby the second computer can access the database to perform the image interpolation on images other than the training images.

27. (Original) The method of claim 25, wherein the database is stored in memory of a printer, whereby the printer can access the database to perform image interpolation on images other than the training images.

28. (Original) The method of claim 13, wherein the representative vectors are generated by using a parameter optimization technique.

29. (Currently amended) Apparatus comprising:

a processor; and

memory means for storing an electronic database and a plurality of executable instructions, the instructions, when executed, instructing the processor to access a training file; generate a low-resolution file from the training file; generate a plurality of cluster vectors from different regions of the low-resolution files; generate a plurality of representative vectors from the cluster vectors ~~low-resolution file~~; generate a set of interpolation filters for each of the representative vectors; and store the interpolation filters and the representative vectors in the memory means as part of the database.

30. (Original) The apparatus of claim 29, wherein the instructions instruct the processor to generate the representative vectors by computing a number NCV of cluster vectors from the low-resolution file, and using the cluster vectors to generate the representative vectors; and wherein the instructions instruct the processor to generate the interpolation filters from low-resolution observation vectors, the cluster vectors, the representative vectors and a plurality of vectors from a high-resolution file corresponding to the low-resolution file.

31. (Original) The apparatus of claim 30, wherein the instructions further instruct the processor to generate a sharpened high-resolution file from the training file, the sharpened high-resolution file being used to compute the interpolation filters.

32. (Original) The apparatus of claim 30, wherein the instructions instruct the processor to generate a classifier including the representative vectors by initializing the classifier and updating the classifier until optimal values for the classifier have been obtained.

33. (Original) The apparatus of claim 30, wherein the instructions instruct the processor to generate each cluster vector by forming an observation window about sampled data in the low-resolution file, extracting a vector including neighboring data of the sampled data, subtracting a value of the sampled data from values of the data in the vector; and scaling the vector.

34. (Original) The apparatus of claim 30, wherein the instructions instruct the processor to compute coefficients for the interpolation filters by:

computing a number NFDV of filter design triplets from data in the low-resolution file, where NFDV is a positive integer, each filter design triplet corresponding to sampled data in the low-resolution file, each filter design triplet including an observation vector for the sampled data, a cluster vector for the sampled data, and a vector of high resolution data from a high-resolution file, the high-resolution data corresponding to the sampled data;

computing training statistics from the filter design triplets; and

computing the coefficients from the training statistics.

35. (Original) The apparatus of claim 30, wherein the interpolation filters are linear filters.

36. (Currently amended) An article of manufacture for instructing a processor to compute a resolution synthesis database from a training image, the article comprising:

computer memory; and

a plurality of executable instructions stored in the computer memory, the instructions, when executed, instructing the processor to compute a low-resolution image from the training image; compute a plurality of cluster vectors from different regions of the low-resolution files; compute a plurality of representative vectors from the cluster vectors ~~low-resolution image~~; and compute a set of interpolation filters for each of the representative vectors; whereby the interpolation filters and the representative vectors form a part of the database.

37. (Original) The article of claim 36, wherein the instructions instruct the processor to compute the representative vectors by computing a number NCV of cluster vectors from the low-resolution image, and using the cluster vectors to compute the representative vectors; and wherein the instructions instruct the processor to compute the interpolation filters from low-resolution observation vectors, the cluster vectors, the representative vectors and vectors from a high-resolution image corresponding to the low-resolution image.

38. (Currently amended) The article of claim 37, wherein the instructions further instruct the processor to compute a sharpened high-resolution mage from the training image, the sharpened high-resolution ~~file~~ image being used to compute the interpolation filters.

39. (Original) The article of claim 37, wherein the instructions instruct the processor to compute a classifier including the representative vectors by initializing the classifier and updating the classifier until optimal values for the classifier have been obtained.

40. (Original) The article of claim 37, wherein the instructions instruct the processor to compute each cluster vector by forming an observation window about a sampled pixel in the low-resolution image, extracting a vector including neighboring pixels of the sampled pixel, subtracting a value of the sampled pixel from values of the pixels in the vector; and scaling the vector.

41. (Original) The article of claim 37, wherein the instructions instruct the processor to compute coefficients for the interpolation filters by:

computing a number NFDV of filter design triplets from pixels in the low-resolution image, where NFDV is a positive integer, each filter design triplet corresponding to a sampled pixel in the low-resolution image, each filter design triplet including an observation vector for the sampled pixel, a cluster vector for the sampled pixel, and a vector of high resolution pixels from a high-resolution image, the high-resolution pixels corresponding to the sampled pixel;

computing training statistics from the filter design triplets; and

computing the coefficients from the training statistics.

42. (Original) The article of claim 36, wherein the representative vectors are generated by using a parameter optimization technique.

43. (Currently amended) An article ~~of manufacture~~ comprising:

computer memory; and

a database encoded in the computer memory, the database including a plurality of sets of resolution synthesis parameters, each set corresponding to an interpolation factor, each set including a classifier and a number M of resolution synthesis filters, each classifier including a number M of representative vectors, wherein the representative vectors are derived from a plurality of cluster vectors and where M is a positive integer.

44. (Original) The article of claim 43, wherein each classifier further includes a variance and a number M of class weights.

45. (Original) The article of claim 43, wherein the number M is between 50 and 100.

46. (New) The method of claim 1, wherein the representative vectors are generated by computing a number of cluster vectors from each low-resolution file and statistically extracting the representative vectors from the cluster vectors.

47. (New) The method of claim 46, wherein the representative vectors are statistically extracted by using a maximum likelihood estimate.

48. (New) The method of claim 46, wherein the representative vectors are statistically extracted by using an expectation maximization technique.

49. (New) The method of claim 46, wherein cluster vectors are computed by sampling the pixels; and for each sampled pixel, creating a vector based on image intensities of pixels neighboring the sampled pixel.

50. (New) The method of claim 49, further comprising performing non-linear filtering on each vector of image intensities.

51. (New) The method of claim 1 wherein windows are formed, each window encompassing a sampled pixel and neighboring pixels; and, for each window, using intensities of pixels inside the window and image behavior of the neighboring pixels to determine the interpolation filters.

52. (New) The method of claim 1, further comprising generating observation vectors and cluster vectors; and using the observation vectors, the cluster vectors, and the representative vectors to generate the interpolation filters.

53. (New) The method of claim1, wherein each representative vector represents a different image behavior.